REMARKS

In section 4 of the Office Action, the Examiner rejected claims 60-62, 64, and 65 under 35 U.S.C. §103(a) as being unpatentable over Khayrallah in view of Brink.

Independent claim 60 - Khayrallah fails to disclose decoding a code vector such that the decoding includes deriving a set of received signal values corresponding to the code vector, and generating a reliability factor based upon a difference between at least two of the received signal values such that the reliability factor is a measure of reliability of the decoding.

Khayrallah discusses an error term. However, this error term is unrelated to decoding reliability and instead is merely a measure of the difference between the channel through which the symbol was transmitted and the equalizer's representation of that channel.

Specifically, the Examiner points to column 7, lines 3-12 and lines 57-64 for a disclosure of the reliability factor recited in independent claim 60.

Column 7, lines 3-12 state that (i) re-encoded, decoded symbols are used from a first pass for calculation of an error term, (ii) the error term is used to update the channel estimate during a second pass, and

(iii) a channel tracker 50 more accurately tracks changes in the channel response of the channel corresponding to the received signal.

The Examiner apparently equates Khayrallah's error term with the reliability factor of independent claim 60. However, Khayrallah's error term is the difference between the symbol as received and the equalized, decoded, and re-encoded symbol. As such, this error term is merely a measure of the difference between the channel through which the symbol was transmitted and the equalizer's representation of that channel. Accordingly, Khayrallah's error term is unrelated to decoding accuracy and is used to adjust the tap weights of the equalizer in a manner so that the equalizer more accurately reflects the actual channel.

As can be seen, Khayrallah's error term has nothing to do with decoding reliability.

Column 7, lines 57-64 state that (i) the output of the mode selector 56 is provided to the adaptive propagation characterization estimator 32, (ii) the mode selector 56 is provided with the decoded and re-encoded symbols, and (iii) these symbols correspond to the estimates of encoded information from the received

signals after processing through the decoder 58 which are associated with particular portions of a received slot.

The reason that the decoded symbols are re-encoded is so that the encoded symbols in the received signal are compared with encoded symbols rather than with decoded symbols in forming the error between the actual channel and the channel estimated by the equalizer 54.

The output of the equalizer 54 could have been used for this purpose because symbols are in the output of the equalizer 54. However, because the decoder 58 is an error correcting decoder, the output of the decoder 58 is a more accurate representation of the transmitted bits, which, when re-encoded, will produce a better channel error term when compared to the received symbols.

As can be seen, the channel error indicates how well the equalizer 54 is equalizing, not how well the decoder 58 is decoding.

Moreover, Khayrallah's error term is not formed based on two values produced by the decoder 58. Instead, Khayrallah's error term is formed based on one value produced by the decoder 58 and one received value, i.e., a value not produced by the decoder, at the input of the equalizer 54.

Indeed, there is no mention any where in Khayrallah of a reliability factor that is a measure of decoding reliability as required by independent claim 60.

Accordingly, Khayrallah does not disclose the reliability factor of independent claim 60.

Brink in Figure 1 shows a serially concatenated coding scheme. A binary signal is encoded first by an outer encoder and is then interleaved to change the order of the bits. The interleaved bits are then encoded by an inner encoder. In the receiver, the received signal is first decoded by the inner decoder, the inner decoded signal is deinterleaved, and the deinterleaved signal is then decoded by the outer decoder.

The outer decoder soft decision values are fed back to the inner decoder and the decoding is repeated with the soft decision values used as input values for the two decoders. The decoding iterations are stopped after a fixed number of iterations or until a certain bit error rate is achieved. The soft decision values input to the inner decoder are set to zero for the very first decoding of the transmitted bit sequence.

According to Brink, a soft value represents the reliability of the bit decision for the respective bit. A soft-in decoder accepts soft reliability values as the

incoming bits. A soft-out decoder provides soft reliability output values for the outgoing bits. The soft-out reliability values are usually more accurate than the soft-in reliability values since they are improved during decoding.

Brink also states that the soft decision values provide information on the reliability of the hard decision values.

However, Brink fails to disclose that a reliability value is based upon a difference between at least two received signal values.

Therefore, like Khayrallah, Brink fails to disclose generating a reliability factor based upon a difference between at least two of the received signal values, wherein the reliability factor is a measure of reliability of the decoding.

For this reason, independent claim 60 is not unpatentable over Khayrallah in view of Brink.

Moreover, Brink has inappropriately used the term "reliability." Brink is not written with the best grammar. Brink apparently really meant to say that a soft value represents a reliable bit decision. For example, in column 2, lines 20-34, Brink states that "[a] soft value represents the reliability on the bit decision

of the respective bit symbol (whether 0 or 1 was sent)" and "[t}he soft-out reliability values are usually more accurate than the soft-in reliability values since they are improved during the decoding process" and "[a] soft-in decoder accepts soft reliability values as the incoming bits."

In other words, these reliability values of Brink are more akin to the received signal values of independent claim 60 than to a reliability factor based upon the received signal values.

Therefore, Brink also does not disclose the reliability factor of independent claim 60.

Because Khayrallah and Brink both do not disclose the reliability factor of independent claim 60, Khayrallah and Brink would not have led the person of ordinary skill in the art to the invention of independent claim 60.

For this reason also, independent claim 60 is not unpatentable over Khayrallah in view of Brink.

Because independent claim 60 is not unpatentable over Khayrallah in view of Brink, claims 61, 62, 64, and 65 *per force* are not unpatentable over Khayrallah in view of Brink.

In section 5 of the Office Action, the Examiner rejected claim 60 under 35 U.S.C. §103(a) as being unpatentable over Khayrallah in view of Chung.

As discussed above, Khayrallah fails to disclose decoding a code vector such that the decoding includes deriving a set of received signal values corresponding to the code vector, and generating a reliability factor based upon a difference between at least two of the received signal values such that the reliability factor is a measure of reliability of the decoding.

Chung describes a communication system 200 in which a source encoder 202 and a channel coder 205 transmit through a channel to a soft-decision channel decoder 215 and a source decoder 220. The soft-decision channel decoder 215 decodes the received bit stream to generate channel-decoded bits that are supplied to the source decoder 220. The soft-decision channel decoder 215 also generates a reliability measure that is supplied to the source decoder 220. The reliability measure is in the form of a log-likelihood ratio for a decoded bit.

A flag generator 222 generates channel error flags from the channel-decoded bits and the reliability measure and supplies the error flags to an error

mitigation and/or concealment element 224 of the source decoder 220. The flag generator 222 checks the reliability measure for each decoded bit against a predetermined threshold. If all bits have reliability measures greater than or equal to the threshold, the bits are error free and no error flag is generated. If a bit has a reliability measure that is smaller than the threshold, an error flag is generated. The mitigation and/or concealment element 224 uses the error flag for error mitigation or concealment.

The log-likelihood ratio for a decoded bit u may be designated L(u) and is generally defined in the literature (See, e.g., "The Decision Reliability of MAP, Log-MAP, Max-Log-MAP and SOVA Algorithms for Turbo Codes," Lucian Andrei Perişoară and Rodica Stoian, INTERNATIONAL JOURNAL OF COMMUNICATIONS, Issue 1, Volume 2, 2008) as

$$L(u) = u\sum_{i=0}^{d}\Delta^{i}$$

The parameter d is the distance from the current node in the decoder, and Δ is generally given as

$$\Delta = \log \frac{P(correct)}{1 - P(correct)}$$

where P(correct) is the probability of the survivor path in the decoder. P(correct) is generally given as

$$P(correct) = \frac{P(path1)}{P(path1) + P(path2)}$$

where P(pathm) is the probability of path m in the decoder.

As can be seen, a reliability measure in the form of a log-likelihood ratio for a decoded bit is not based upon a difference between at least two received signal values derived by decoding a code vector into a set of received signal values corresponding to the code vector.

Therefore, like Khayrallah, Chung fails to the disclose a reliability factor based upon a difference between at least two received signal values derived by decoding a code vector into a set of received signal values corresponding to the code vector.

Because Khayrallah and Chung both do not disclose the reliability factor of independent claim 60, Khayrallah and Chung would not have led the person of

ordinary skill in the art to the invention of independent claim 60.

For this reason, independent claim 60 is not unpatentable over Khayrallah in view of Chung.

In section 6 of the Office Action, the Examiner rejected claim 66 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Weng.

Contrary to the assertion of the Examiner, Gosse fails to disclose reliance on a reliability factor that is a measure of decoding reliability.

According to Gosse, the stopping rule 70 measures channel quality. Thus, Gosse directly contradicts the Examiner.

More specifically, the stopping rule 70 measures channel quality by comparing the output of the equalizer 40 to a reference (provided as the re-encoded output of the decoder 56; the decoder 56 is able to provide some correction of the equalizer output). If the output of the equalizer 40 is significantly different than the reference, the channel is poor; whereas, if the output of the equalizer 40 is not significantly different than the reference, the channel is good.

If the stopping rule 70 were a measure of the reliability of the decoder 56, then re-encoding would not

be required and the stopping rule 70 would instead make a measure that is internal to the decoder, such as looking at the decoding process itself as is done in the present application.

Moreover, Weng does not disclose a reliability factor that is a measure of reliability of the decoding. Instead, Weng states that corrupted code words c(j) have associated therewith reliabilities r(j) which are generated by a channel processor not disclosed in Weng. The values r(j) along with the error pattern bits b(j) are fed to an error pattern reliability computation circuit 34. The error pattern reliability computation circuit 34 tallies the reliability of the error pattern symbols b(j) as

$$S = s(1) + s(2) + \ldots + s(e)$$

where s(j) is the reliability for a location associated with the bit b(j).

The error pattern reliability output S is compared at 42 to a reliability threshold in order to determine whether the output of a hard decoder 32 can be accepted as the output of the decoder 30 or whether a

soft decision decoding process 44 should be invoked to provide the output from the decoder 30.

Weng does not disclose how the reliabilities r(j) are generated. However, it is clear that the decoders 32 and 44 do not generate them. Therefore, the reliabilities r(j) cannot be generated based upon a received signal value resulting from decoding a code vector, and cannot be a measure of reliability of decoding.

Accordingly, because both Gosse and Weng fail to disclose reliance on a reliability factor that is a measure of decoding reliability, Gosse and Weng would not have led the person of ordinary skill in the art to the invention of independent claim 66.

For this reason, independent claim 66 is not unpatentable over Gosse in view of Weng.

In section 7 of the Office Action, the Examiner rejected claim 67 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Weng and further in view of Khayrallah.

However, Khayrallah fails to make up for the deficiencies of Gosse and Weng. Therefore, Gosse, Weng, and Khayrallah would not have led the person of ordinary

skill in the art to the invention of independent claim 66.

For this reason, independent claim 66 is not unpatentable over Gosse in view of Weng and further in view of Khayrallah.

Because independent claim 66 is not unpatentable over Gosse in view of Weng and further in view of Khayrallah, dependent claim 67 *per force* is not unpatentable over Gosse in view of Weng and further in view of Khayrallah

In section 8 of the Office Action, the Examiner rejected claims 68-71 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Weng and further in view of Webster.

However, Webster fails to make up for the deficiencies of Gosse and Weng. Therefore, Gosse, Weng, and Webster would not have led the person of ordinary skill in the art to the invention of independent claim 66.

For this reason, independent claim 66 is not unpatentable over Gosse in view of Weng and further in view of Webster.

Because independent claim 66 is not unpatentable over Gosse in view of Weng and further in

view of Webster, dependent claims 68-71 *per force* are not unpatentable over Gosse in view of Weng and further in view of Webster

In section 9 of the Office Action, the Examiner rejected claims 73 and 79 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Xu.

As discussed above, Gosse fails to disclose generating a reliability factor based upon at least one value decoded by a decoder such that the reliability factor is a measure of the reliability of the decoding.

Xu is no different from Brink or Chung and, therefore, likewise fails to disclose generating a reliability factor based upon at least one value decoded by a decoder such that the reliability factor is a measure of the reliability of the decoding.

Because Gosse and Xu fail to disclose generating a reliability factor based upon at least one value decoded by a decoder such that the reliability factor is a measure of the reliability of the decoding, Gosse and Xu would not have led the person of ordinary skill in the art to the inventions of independent claims 73 and 79.

For this reason also, independent claims 73 and 79 are not unpatentable over Gosse in view of Xu.

In section 10 of the Office Action, the Examiner rejected claims 75, 77, 78, 81, and 83 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Xu and further in view of Webster.

However, Webster fails to make up for the deficiencies of Gosse and Xu. Therefore, Gosse, Xu, and Webster would not have led the person of ordinary skill in the art to the inventions of independent claims 73 and 79.

For this reason, independent claims 73 and 79 are not unpatentable over Gosse in view of Xu and further in view of Webster.

Because independent claims 73 and 79 are not unpatentable over Gosse in view of Xu and further in view of Webster, dependent claims 75, 77, 78, 81, and 83 *per force* are not unpatentable over Gosse in view of Xu and further in view of Webster.

In section 11 of the Office Action, the Examiner rejected claims 74, 76, 80, 82, and 84 under 35 U.S.C. §103(a) as being unpatentable over Gosse in view of Xu and further in view of Kayrallah.

However, Kayrallah fails to make up for the deficiencies of Gosse and Xu. Therefore, Gosse, Xu, and Kayrallah would not have led the person of ordinary skill

in the art to the inventions of independent claims 73 and 79.

For this reason, independent claims 73 and 79 are not unpatentable over Gosse in view of Xu and further in view of Kayrallah.

Because independent claims 73 and 79 are not unpatentable over Gosse in view of Xu and further in view of Kayrallah, dependent claims 74, 76, 80, 82, and 84 *per force* are not unpatentable over Gosse in view of Xu and further in view of Kayrallah.

CONCLUSION

In view of the above, allowance of all claims and issuance of the above captioned patent application are respectfully requested.

The Commissioner is hereby authorized to charge any additional fees that may be required, or to credit any overpayment, to account No. 26 0175.

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